Physiological and Hormonal Responses of Egyptian Buffalo to different Climatic Conditions

By:

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INTODUCTION

- **The optimum climatic conditions for buffaloes are: ambient temperatures of 13–18 °C combined with an average relative humidity of 55–65%, a wind velocity of 5–8 km/h and a medium level of sunshine (Marai and Habeeb, 2010).**

- **The global surface air temperature increased by 0.76 °C from year 1850 to year 2005 (IPCC, 2007), while in Egypt, the temperature increased from 1975-2004 by 0.46 °C (Khalil *et al*., 2008).**

INTODUCTION

- **Climate change could affect animal production in four ways: (a) feed-grain availability and price; (b) pastures and forage crop production and quality; (c) changes in the distribution of livestock diseases and pests and (d) the direct effects of weather and extreme events on animal health, growth and reproduction (Smit *et al.,* 1996).**
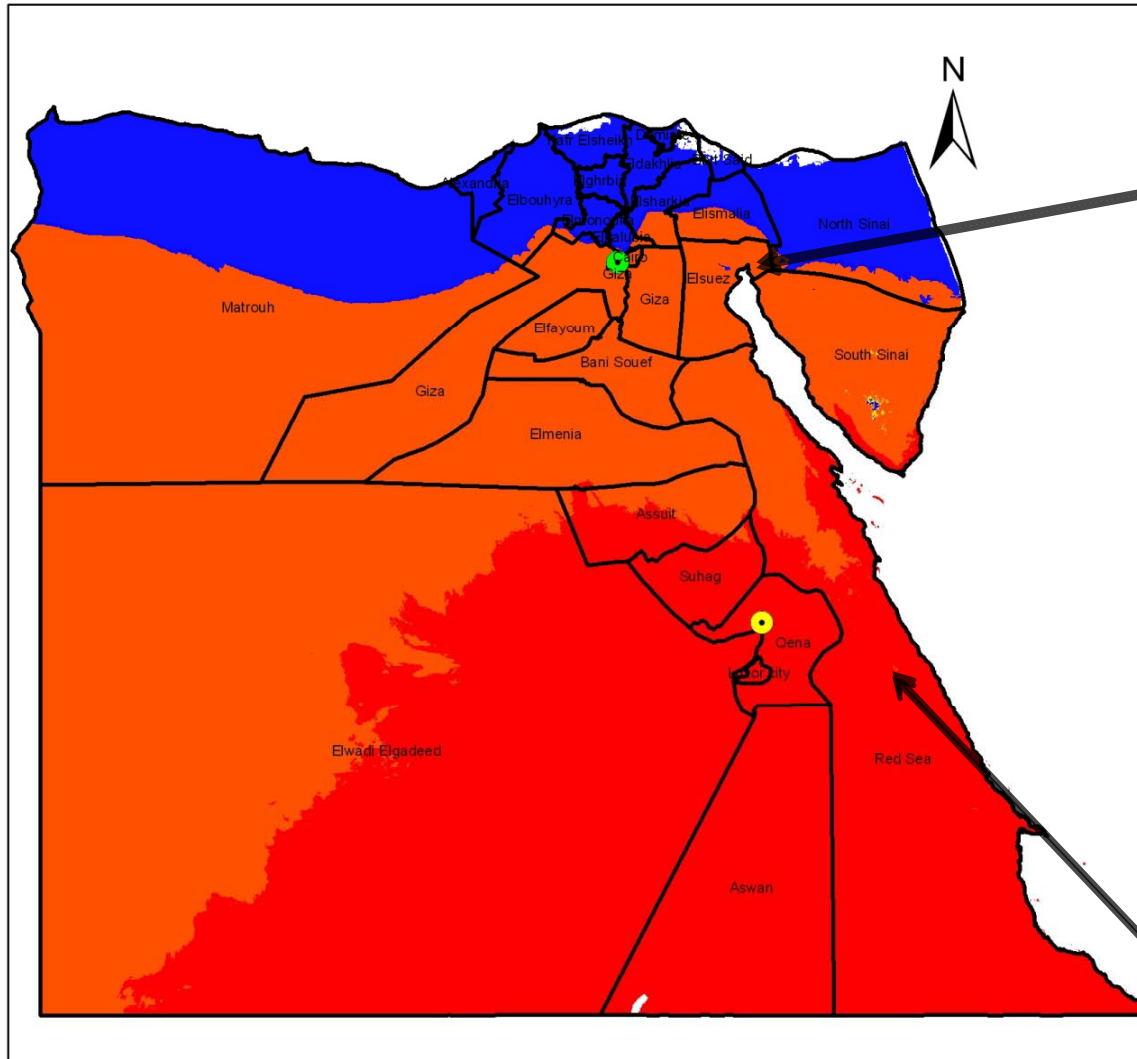
OBJECTIVES

- **The objective of this study was to investigate the homeostatic reactions in some hormonal and physiological responses in Egyptian buffaloes due to the change in two different climatic zones of Egypt during summer.**

Materials and Methods
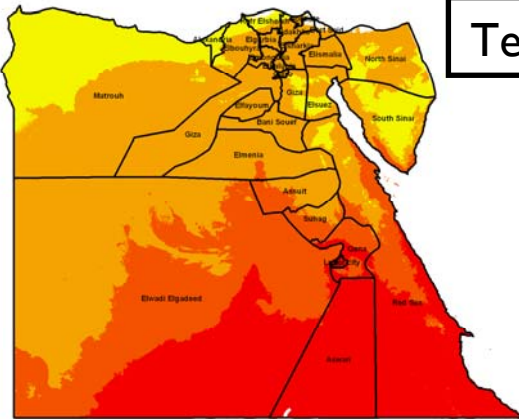
1- The map of agro-meteorological zone
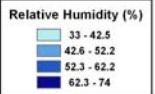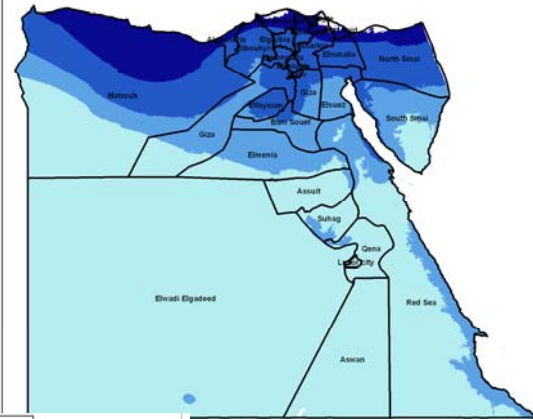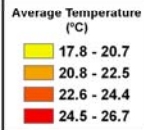

Farm Location

- 🟢 Giza Farm
- 🟡 Qena Farm

Temperature

Relative Humidity

Rainfall
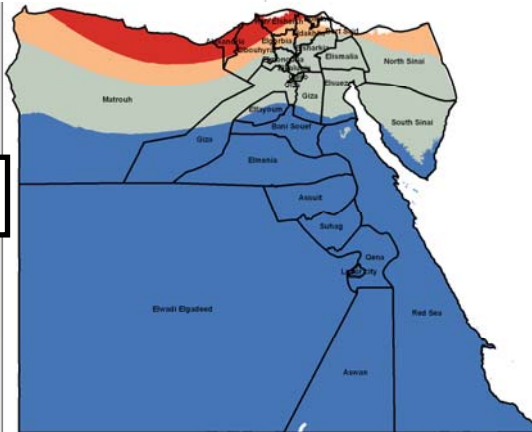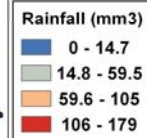
Wind speed
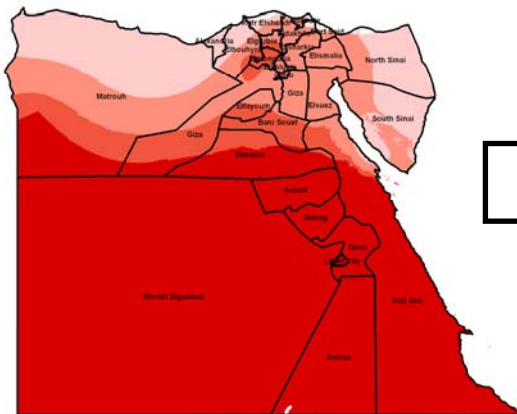
Sunshine hours
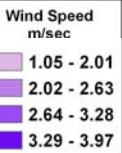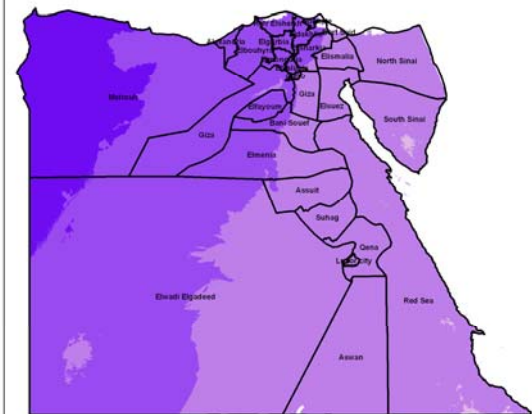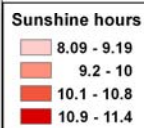
2- Animals

- **Sixteen multiparous lactating buffalos (3-6 parities) were assigned to this experiment, six from a farm located in Giza governorate and ten from a farm located in Qena governorate.**

- **The buffaloes were housed in open yards with metal roofs covered the third of the surface area of the stalls.**

3- measurements

1. **Environmental**

- **Ambient temperature (AT,˚C) and relative humidity (RH, %) measured to calculate the Temperature - Humidity Index (THI) according to (Mader *et al.*, 2006) as follow:**

THI = [0.8 × ambient temperature] + [(% relative humidity ÷ 100) × (ambient temperature − 14.4)] + 46.4

2. physiological parameters

The physiological parameters were taken twice a day (0900h and 1600h) fortnightly through the period of the study.

- **Rectal temperature**
- **Skin temperature (rump, dorsal, nick and ear).**
- **Eye temperature.**
- **Respiration rate**.

3. Hormonal parameters

Blood samples were collected at 0900 h before the morning feeding to Separate plasma for analysis:-

- **Total triiodothyronine (TT3).**
- **Total thyroxine (TT4).**
- **Cortisol concentration.**

4. Statistical analysis

Data analyzed using (SAS, 2002) by using the following model:

$$Y_{ijk} = \mu + F_i + P_j (F_i) + e_{ijk}$$

Results and Discussion

Environmental conditions

Parameters	Qena	Giza
Average Temperature (ºC)	**27.3 ± 1.48**	24.9± 1.59
Average Relative Humidity (%)	43.9± 2.41	**61.1 ± 3.29**
Average daily THI	**74 ± 1.76**	73 ± 2.05
Number of days daily THI>74*	39	24
Number of days daily THI>72**	69	46
Number of days daily THI>69***	93	91

* **Hahn** *et al.*, **2003   ** Bouraoui** *et al.*, **2002 *** Mader** *et al.*, **2006**

➤ Physiological responses

1. Rectal temperature

Variables	Qena	Giza
Rectal Temp. (°C)	38.51 ± 0.05^a	38.38 ± 0.11^a
Morning Rectal Temp.	**38.33 ± 0.06^a**	38.05 ± 0.11^b
Evening Rectal Temp.	38.68 ± 0.06^a	38.63 ± 0.14^a

2. Skin temperature

Variables	Qena	Giza
Rump Temp. (°C)	37.26 ± 0.21^a	34.90 ± 0.34^b
Morning Rump Temp.	37.86 ± 0.23^a	34.27 ± 0.39^b
Evening Rump Temp.	36.63 ± 0.30^a	35.49 ± 0.37^b
Dorsal Temp. (°C)	37.16 ± 0.18^a	34.71 ± 0.46^b
Morning Dorsal Temp.	37.57 ± 0.18^a	34.34 ± 0.47^b
Evening Dorsal Temp.	36.68 ± 0.24^a	35.05 ± 0.54^b
Neck Temp. (°C)	36.68 ± 0.17^a	34.92 ± 0.31^b
Morning Neck Temp.	36.86 ± 0.17^a	34.67 ± 0.34^b
Evening Neck Temp.	36.43 ± 0.22^a	35.12 ± 0.37^b
Ear Temp. (°C)	36.94 ± 0.14^a	35.56 ± 0.32^b
Morning Ear Temp.	36.93 ± 0.16^a	34.54 ± 0.37^b
Evening Ear Temp.	36.91 ± 0.18^a	36.55 ± 0.33^a

3.   eye temperature

Variables	Qena	Giza
Eye Temp. (°C)	**36.97 ± 0.09[a]**	35.39 ± 0.23[b]
Morning Eye Temp.	**37.02 ± 0.12[a]**	34.83 ± 0.27[b]
Evening Eye Temp.	**36.91 ± 0.12[a]**	35.92± 0.24[b]

4.   Respiration rate

Variables	Qena	Giza
Respiration Rate (Insp./min)	23 ± 0.8^a	24 ± 1.12^a
Morning Respiration Rate	**23 ± 0.84^a**	20 ± 1.15^b
Evening Respiration Rate	23 ± 0.94^a	**27 ± 1.54^b**

➤ Hormonal responses

Hormones	Qena	Giza
Thyroxin (nmol/l), TT4	$47.19^a \pm 1.41$	$44.32^a \pm 1.20$
Triidothyronine (nmol/l), TT3	$1.11^a \pm 0.05$	$0.90^b \pm 0.03$
TT4/TT3	$47.19^a \pm 1.42$	$52.05^a \pm 3.12$
Cortisol (nmol/l)	$81.12^a \pm 4.59$	$69.81^a \pm 5.93$

➢ Correlation among some physiological parameters and THI

	RT	RuT	DT	NT	ErT	EyT	RR
THIavg	**0.18** **(0.0998)**	0.45 (<.0001)	0.35 (0.0012)	0.39 (0.0003)	0.40 (0.0001)	0.38 (0.0003)	**0.10** **(0.3894)**

Conclusion

- **Relevant hormonal and physiological responses of Egyptian buffalo were a good indicator to the homeostatic reactions due to the climatic conditions in the current study**

- **THI alone is not a good indicator to heat stress without the physiological parameters**

- **Eye temperature could be used an indicator to the change in body temperature**

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Thank You!